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Developing Mathematical Learning Device Using Ttw (Think- Talk-Write) Strategy Assisted By Learning Cd To Foster Mathematical Communication

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Abstract

This research aims to produce mathematical learning device or tool using TTW strategy that is valid, practical, and effective. The developed device consists of syllabi, Learning Implementation Plan (RPP), Student Reading which is packaged in CD (BBS), and an evaluation tool. Receiver of treatment or Subjects are the eighth grade students of Muhammadiyah Junior High School in Purworejo. First experiment held in the class A of eighth grade students aimed to determine the legibility of device and the level of difficulty, distinguishing features, and reliability test learning outcomes. Second experiment conducted in class C of eighth grade students aimed to verify the practicality of the device and the effectiveness of learning using developed devices, whereas the class G is as control class. Results from 5 validations of the device are: the mean score of syllabi is 3.48; RPP is 3.79; BBS is 3.73; LKS is 3.73; assessment tool is 3.71 (on scale 1-4). Such results mean that validation criteria of the device is valid. The score of experiment results showed that the criteria of learning process is 3.80; the students' response is 93.85%; the teacher's score is 3.91, that means it's a practical device. Learning using the devices results a classical learning mastery, and achievement test of an experimental class is better than the control class. Furthermore, student's activity has a positive influence for achievement, so it's the effective device.

Key words: *developed device, Think-Talk-Write (TTW), the mathematical learning*

I. INTRODUCTION

The Curriculum of Education Unit Level (SBC) for mathematics states that mathematics is given to students from elementary schools up in order to equip them to be capable of logical, analytical, systematic, critical, and accurate thinking, and able to work together. Competencies are necessary for students to have the ability to obtain, manage, and utilize the information to survive in the ever-changing, uncertain, and competitive circumstances. Competency standards and the basis for a mathematics lesson in the curriculum are drawn up as a foundation of learning to develop the abilities mentioned above. In addition, they are also intended to develop the ability to use mathematics in solving problems and in communicating ideas by using symbols, tables, diagrams, and other media.

The learning that fits in the curriculum is the expectation of all parties concerned with education, and to achieve this, among others, it is required the active participation of teachers, students, classroom atmosphere that supports the learning-oriented students.

Learning activities that will be implemented to be completely planned to increase students' understanding that ultimately have an impact on learning outcomes are good. Marpaung (2003:3) suggests that when students have optimal learning experience, so the task is no longer active. Teacher not only gives knowledge (transfer of knowledge) from his mind into the minds of students in the classroom, but also creates conditions of learning. Moreover, he or she plans the course of learning with a choice of a suitable and representative material.

To obtain the optimal results, preparation is essential, especially preparation for how the material is packaged and for how the settings and props learning are taken (Marpaung, 2006:6). The accuracy of the selection and use of approaches, strategies, methods, techniques, and the means (media) will determine the learning achievement of learning objectives.

A learning strategy that is expected to grow and to develop students' mathematical communication skills is Think - Talk - Write (TTW) strategy. The strategy is introduced by Huinker & Laughlinn (1996:82) which is basically built through thinking, speaking, and writing. The flow advances of TTW strategy starts from the involvement of students in thinking or in having dialogue with themselves after the process of reading. Then, they talk and share ideas with his friend before writing. This atmosphere is more effective if it is done in a heterogeneous group consisting of 3-5 students. In this group, students are asked to read, to make a little note, to explain, to listen, to share with friends, and to express ideas through writing.

Based on the above description, it can be raised formulation of the problem: (1). How is the process of developing mathematical learning tools using CD assisted by learning strategies of TTW?, (2) Is the development of mathematical learning tools using CD assisted by learning strategies of TTW valid, practical, and effective?

The purposes of this study are (1) to know the process for the development of mathematical learning tools using CD assisted by learning strategies of TTW, (2) to generate mathematical learning device that uses CD assisted by learning strategies of TTW which is valid, practical, and effective.

The benefits of learning tools produced through this research can train students to improve mathematical communication skills of writing and as inputs as well as a

reference for researchers in the field of mathematics learning, especially with regard to the development of learning tools.

To determine the quality of the learning, this study refers to the criteria which are developed by Nieveen (1999). In developing the curriculum, Nieveen says that quality is stated to satisfy several criteria, i.e. validity, practicality, and effectiveness.

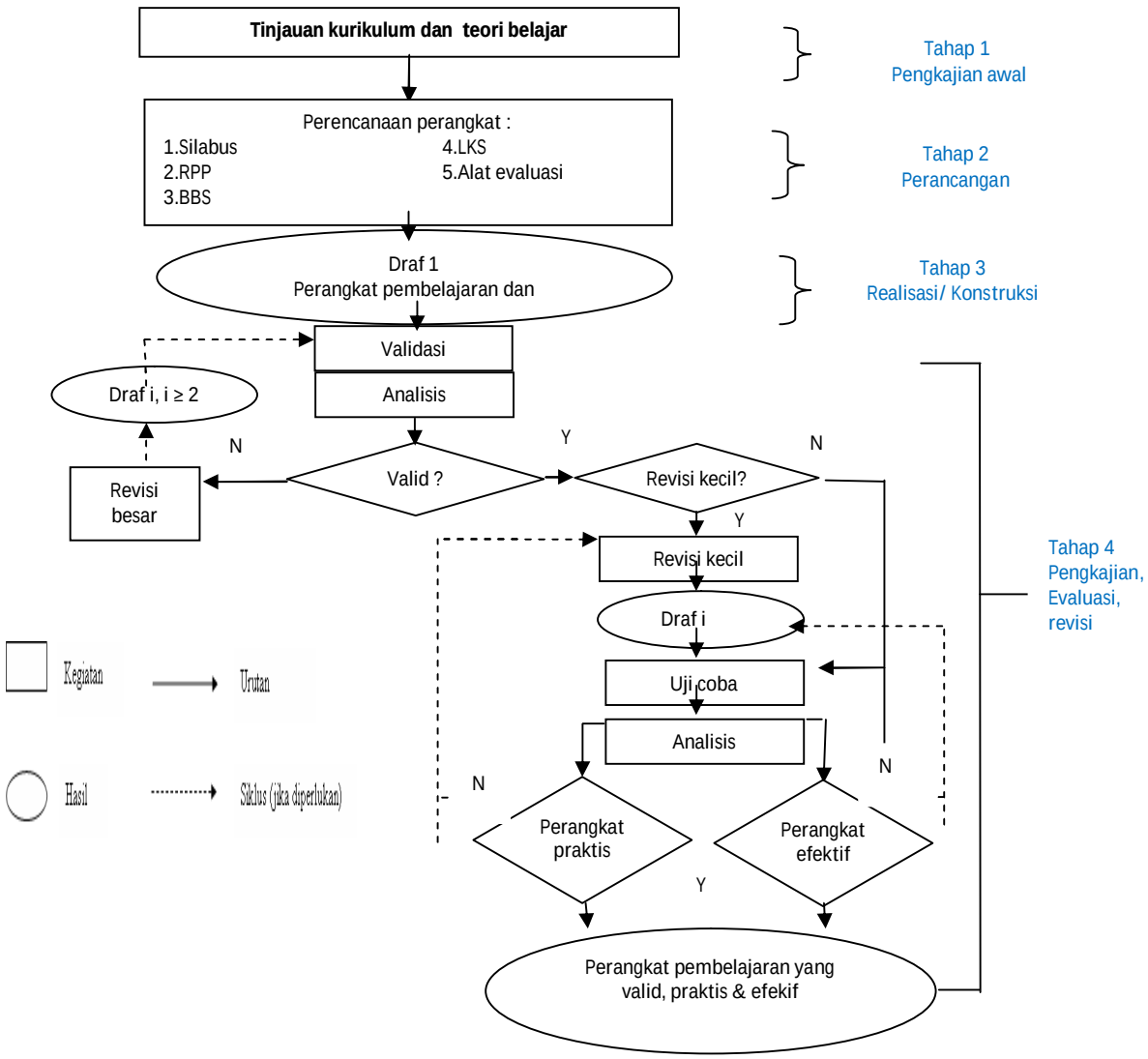
The process of communication is the process of delivering the introductory message of the communicator to the receiver. Failure in understanding what is heard, read, seen and observed, depends on the communication process that occurs. Growing number of verbalisme receives more abstract understanding. It is therefore indispensable medium of learning. Instructional media in this study contains a CD which includes Student Reading Materials (BBS) provided with Flash MX animation.

II. DISCUSSION

This research is intended to develop the learning tools that meet the criteria for being valid, practical, and effective which consists of Syllabus, Learning Implementation Plan (RPP), Student Reading Materials (BBS), Student Activity Sheet (BLM), and Assessment Tool (THB).

The subject of this study is the eighth grade students of Muhammadiyah Junior High School of Purworejo in the academic year of 2009/2010. In trying to draft the device is a class VIIIA that consist of 40 students, at the implementation stage of learning tools that have been validated and revised in the previous stage, the study subjects were 80 students who were divided into 2 classes of 40 students in grade VIII C as the experimental class and 40 students in grade VIII G as a control class with the first tested homogeneity.

Development of learning tools uses a modified model of Plomp, so the plot is described in the following figure.



RESEARCH RESULTS

1. The results Learning Development Tools

   The device consists of learning developed (1) Syllabus, (2) Learning Implementation Plan (RPP), (3) Student Reading Materials (BBS), (4) Student Activity Sheet (LKS) and (5) Assessment Tool (THB).

2. The quality of the learning device

   The validation device learning Tables

No	Type of device	Means	Criteria
1	Silabus	3,48	Valid
2	RPP	3,79	Valid
3	BBS	3,83	Valid
4	LKS	3,83	Valid
5	THB	3,71	Valid

3. Practicality test

   Observation on the implementation of learning is done by two observers, including both categories, namely KM = 3.80, which means implementation of learning is good. More than 80% of students gave positive responses, ie 93.85% of students gave good and excellent ratings. Teachers respond well to the implementation of learning the score 3.91.

4. Test the effectiveness of Learning Tools

   In the development of learning tools, to determine whether a device developed effective or not based on the indicators: (1) exhaustiveness classical learning, (2) differences in student achievement between the experimental class with a grade control, and (3) there is a positive influence students' activeness on learning achievement. To find out achieved or not these indicators should be carried out hypothesis testing.

5. Homogeneity of Variance Test

   Homogeneity of variance test is done by calculating the significance of the similarity of variance values report cards, if both classes have the same variance then said to the two homogeneous groups.

   a. Similarity test variants

      The results of calculations obtained Sig = 6, 423 = 642.3% to the level of variance test, greater than 5% that is not significant, H0 is accepted, means that the same variant, so that the chosen assumptions: *aqual variant assumed.*

   b. Test results of the initial capability

      The results of calculations obtained sig = 0, 742 = 74.2% more than 5% means insignificant, H0 is accepted, or there is no difference between the initial

capabilities of the control class with the class experiment. Then control class and experimental class are homogeneous.

6. Test of exhaustiveness learning
   a. Average test (test on the right).

      The results of calculations based on table put out one Sample Test obtained a significance value of 0.007 = 0.7% smaller than 5% so that Ho is rejected. Instead accept Ha which is an average test result of learning to achieve at least 62, means that students have achieved learning exhaustiveness.

   b. Test the proportion π (test one party).

      Based on calculations obtained by calculating z is 2.19. With a significance level of 5% and N = 40, x = 36 is obtained z table 1, 736. Because the count z > 0.5 z - α then Ho is rejected and Ha accepted, means that the proportion of students who scored ≥ 62 to 75%. So the classical students reach exhaustiveness.

7. Test appeal
   a. Similarity test variants

      The results of calculations obtained Sig = 11.043 = 1104.3% for level variant tests, greater than 5% that is not significant, means that Ho received the same variant, so that the chosen assumptions: aqual variant assumed.

   b. Test results of testing the ability of learning outcomes

      To determine whether the ability of the test results of experimental class learning is better than control class, can be seen at the output of the average difference, it seems that the mean of experimental class is larger than control class, which means the ability of the test results of experimental class learning better than control class.

8. Regression test

   Based on the output coefficient, regression equation is: Y = 55.566 + 0.273 X MAS Based on out put sig = 0.000 = 0% smaller than 5% means that Ho is rejected, means they are linear equations. Large contribution to the student active student learning outcomes is seen in the value of R square = 0281 = 28.1%, means that the activity has positive effects on student learning outcomes, which is active affects learning outcomes of 28.1%, 71.9% affected the balance of other variables . Based on the

results of testing three indicators can be concluded that the devices meet the criteria for effective learning.

EXPLANATION

1. **Discussion of the learning process of software development**

   Model development process refers to the General Troubleshooting of Education is introduced by Plomp. In phase I conducted studies in the literature about the math curriculum Junior Class VIII. In Phase II, make the design of learning tools using a strategy of TTW. In phase III of the draft realizing learning device comprising (1) Syllabus, (2) RPP, (3) BBS CD packaged in learning, (4) BLM, and (5) assessment tool. Researchers also make the instrument comprising (1) observation sheet implementation of learning, (2) observations of student activity sheets, (3) questionnaire responses of students, (4) teachers' questionnaire responses, and (5) copies of the validation and scoring guidelines for syllabi, lesson plans , LKS, BBS, evaluation tool. In phase IV of the draft device is validated by five Validator to produce a valid device. Furthermore, the device tested on the test class A to class VIII to know the readability level and the level of difficulty questions, distinguishing features and reliability problems. After minor revisions the devices tested on the experimental class VIIIC class. In this trial conducted observations on the implementation of active learning and students. At the end of the lesson using the learning tools that have been developed, students are asked to fill out the questionnaire responses of students, and teachers please fill out the questionnaire responses of teachers. To find out the results of student learning, students are asked to work on the problems that have been declared reliable. The test results are also given to students studying the control of homogeneous classes with a class of experiments based on the test of homogeneity, ie class VIII G. Further test results on the experimental classes performed the analysis.

2. **Discussion of the results of the development of a valid learning tools**

To produce a valid learning tools, has made some revisions based on the results of the assessment validator. Based on the assessment of the validator, the devices have been developed to obtain a mean score of 3.73 for the grading scale 1-4 that includes a valid criterion.

3. Discussion of the results of the development of practical learning tools

Data for this practicality is obtained by observing the implementation of learning to use devices that have been developed. Said learning device developed practical if the observations on the implementation of a minimum learning included in either category. Based on these three criteria are so practical mathematics learning device with a CD-assisted learning strategies material TTW.

4. Discussion of the results of the development of effective learning tools

The device is said to be effective when learning to use such devices provide results that meet the indicators. At each end of the meeting conducted tests self test and the results are assessed and discussed. After learning experiments to learn the results of tests done to determine students' written communication skills. The test results were analyzed using the test exhaustiveness learn by using KKM 62.

Based on observation, all students showed a high level of activity based on ten indicators of activity. Further analysis is whether there is a positive influence on learning outcomes of students liveliness. Analyses were performed using a regression test using SPSS acquired sig = 0.000 = 0%, far below 5% so it can be said that it is a linear equation significantly, or the activity of students during the learning actually significantly influence learning outcomes. Cosmos, the contribution of activity students learning outcomes in the amount of 0.281 = 28.1% means effectiveness students during the learning has positive effects on learning outcomes of the activity affects the learning outcomes of 28.1% while the remaining amount of 71.9% is influenced by other factors, eg talents, interests, IQ, and other factors that have not been studied.

With three indicators of the effectiveness of learning are met, it can be concluded that the development and outcome of learning mathematics with software development strategies of learning materials CD-assisted TTW room flat side up pyramid is effective to develop mathematical communication skills of writing.

III. CONCLUSION AND SUGGESTION

A. CONCLUSION

1. The process of developing learning tools using CD assisted by learning strategy of TTW refers to the General Problem Solving Model of Education is firstly introduced by Plomp (1997).
2. Learning device consists of (1) Syllabus, (2) RPP, (3) BBS, (4) BLM, and (5) Assessment Tool. Based on the results of validation of experts with the scale of 1-4, it is obtained an average score of Syllabus = 3.48; RPP = 3. 9; BBS = 3.83; LKS = 3.83 and Assessment Tool = 3.71. Thus, it can be included as valid criteria.
3. Learning is a practical device, characterized by three criteria which are met practicality. They are:
   a. Implementation of the lessons is learned by the average score of 3.80;
   b. As many as 93.85% of students give good and excellent ratings;
   c. The teacher responds well to the implementation of learning with an average score of 3.91.
4. Learning to use devices that have been developed is effective. It is marked by three indicators of learning effectiveness. They are:
   a. The proportion of students whose score are $\geq$ 62% to 75%.
   b. Means test scores of experimental class which is 69.63; mean control class which is 41.13.
   c. Activity to learn which affects the outcome of 28.1%

B. SUGGESTION

1. The teacher implementing the learning of mathematics using a CD assisted by learning strategy of TTW should understand the syntax, regulate the formation of the students' seat, so that students can discuss well. In addition, it is necessary to have some assistance for setting up a computer laboratory to overcome when an interruption occurs.
2. Teachers should have the ability to lead a discussion, so that activities can be done well. Furthermore, the communication among students can grow and develop.
3. Tests of learning outcomes need to be developed in the cognitive application, analysis, synthesis, and evaluation. Moreover, they need to be tested on a wider scale.

IV. BIBLIOGRAPHY

Ansari, B.I.2004.*Menumbuhkembangkan Kemampuan Pemahaman dan Komunikasi Matematik Siswa SMU melalui Strategi Think-Talk-Write*. Disertasi Doktor pada PPS UPI Bandung: tidak diterbitkan

Arikunto, S. 2006. *Prosedur Penelitian Suatu Pendekatan Praktik.* Jakarta: Rineka Cipta.

Arikunto, S. 2007. *Dasar-dasar evaluasi pendidikan.* Jakarta: Bumi Aksara.

Arsyad, A. 2006.*Media Pembelajaran*, Jakarta :PT Raja Grafindo Perkasa

Baroody, A.J.1993. *Problem Solving, Reasoning, and Communicating*. New York: Macmillan Publising.

Budiyono, 2003. *Metodologi Penelitian Pendidikan*, Surakarta: Sebelas Maret University Press

Cai & Jakabesin.1998. Assessing Students' Mathematical Communication. *School Science and Mathematics Jaurnal*. 96(5): 238-246.

Departemen Pendidikan Nasional. 2008a. *Pengembangan Rencana Pembelajaran*.

http://www.depdiknas.go.id/jurnal/50 (15 Maret 2009).

Departemen Pendidikan Nasional. 2008b. *Pengembangan Bahan Ajar* . http://www.depdiknas.go.id/jurnal/51 (15 Maret 2009)

Greenes, K dan Shulman, L. 1996. *Comminucation Processes in Mathematical Exploration and Investigation*. In. P. C. Elliot and M.J. Kenney (Eds). Years Book 1996. Communication in Mathematics K-12 and Beyond. USA:NCTM

Huinker, D. dan Laughlin, C. 1996. Talk You Way into Writing. In. P. C. Elliot and M.J. Kenney (Eds). Years Book 1996. *Communication in Mathematics K-12 and Beyond*. USA:NCTM

Mariani. 2008. *Evaluasi Keterampilan Menulis dalam Matematika.* http://scmariani-unnes.blogspot.com/2008/11/evaluasi-keterampilan-menulis-dalam.html.(22 November 2008)

Marpaung, Y. 2003. *Perubahan Paradigma Pembelajaran Matematika di Sekolah.* Makalah disajikan dalam Seminar Nasional Pendidikan Matematika di Universitas Sanata Darma. Tanggal 27-28 Maret 2003. Yogyakarta: Universitas Sanata Darma.

----------. 2006. *Metode Pembelajaran Matematika untuk Anak SD/MIN*. Makalah disampaikan pada Sarasehan Pengembangan Pembelajaran di SD dan TK Fakultas Ilmu Pendidikan, UNY, Karangmalang, Yogyakarta. 1 Oktober 2006.

Nieveen, N. 1999. *Prototyping to Reach Product Quality.* In Jan Van den Akker. R.M. Branh,K. Gustafson, N. Nieveen & Tj. Plomp (Eds) *Design Approaches and Tools in Education and Training* (pp 125 – 135). Dordrecht, Nederland: Kluwer Academic Publisher.

Plomp, T. 1997. *Educational and Training System Design.* Enschede, The Netherlands: Univercity of Twente.

Silver, A. E & Smith, S. M .1996. *Building Discourse Communities in Mathematics Classroom.* In. P. C. Elliot and M.J. Kenney (Eds). Years Book 1996. Communication in Mathematics K-12 and Beyond.

Sipka, T. 1989. Writing in Mathematics: A Plethora of Possibilities. Using Writing to Teach Mathematics. (Ed) Andrew Sterrett. *Mathematical Association of America* (*MAA Notes Series*). USA:NCTM.

Sukestiyarno. 2008. *Modul kuliah SPSS.* Handout perkuliahan Program Magister Program Studi Didas Matematika. Semarang: Unnes.

Sulivan, P. & J. Mousley, Natural Communication in Mathematics Classroom: What Does It Look Like?. In P.C. Clarkson (Ed.) *Technology in Mathematics Education.* Melbourne: Merga, 1996